
3. FINDINGS ON USMC ACTIVITIES AT CAMP LEJEUNE

This section describes the details of the Panel's findings related to the discovery of TCE and PCE contamination in two drinking water systems at Camp Lejeune in the early 1980s. The Panel's findings are based on its review of relevant documents and interviews with current and former military personnel and regulators. The Panel is satisfied its findings are valid based on review of the information available, but emphasizes that additional information that may have provided a more comprehensive understanding was not available. Specifically, there are gaps in how information was communicated among Camp Lejeune personnel and between LANTDIV and Camp Lejeune. In certain cases former personnel stated they could not remember certain facts surrounding the time, noting the length of time that had passed since the early 1980s. Additionally, the Panel was not able to locate and interview any personnel from the Preventive Medicine department at Camp Lejeune.

3.1 Camp Lejeune Drinking Water System

Most of the water system serving Camp Lejeune in the 1980s was constructed when the Camp was built in the 1940s. The base's drinking water was extracted from approximately 100 groundwater wells (in 1984), treated at eight treatment plants (Tarawa Terrace, Hadnot Point, Holcomb Boulevard, Courthouse Bay, Rifle Range, Onslow Beach, Montford Point, and New River), and provided to residents through a network of distribution pipes. Attachment H shows the distribution system for Tarawa Terrace, Hadnot Point, and Holcomb Boulevard. The plants were designed to store raw water until treatment, soften the water by adding lime, conduct filtration to remove sediments, disinfect, fluoridate, and store the treated water until it was pumped to the distribution systems. The Marine Corps followed a general practice of rotating well operations to provide greater reliability and a factor of safety against high demands or system failure. Although the Marine Corps currently conducts significantly more sampling and analysis to ensure human health is protected, this process is still used today. Schematics for the drinking water treatment process at the Hadnot Point and Holcomb Boulevard systems are provided in Attachments I and J, respectively.

Theoretically, it would be possible to calculate the potential past exposure to contaminants that any individual consumer served by these systems may have experienced. To do this, the following information is needed:

- Hourly flow from each water supply well,
- Contaminant concentrations under various pumping conditions, as projected based on historical data,
- Raw and treated water system facilities and their conditions as it existed at the time,
- Operating procedures for the water treatment plants, including actual schedule for use of wells,
- Use of available balancing storage—both raw and treated, and
- Daily (preferably hourly) water demand patterns for all uses on a given system.

Each piece of this information is necessary to determine exposure. If actual data are not available, as is generally the case at Camp Lejeune, it would be necessary to make a series of assumptions. Each assumption would reduce confidence in the results. The available data are presented in Attachment K, which shows the number of wells that existed prior to 1985. It is unclear how the pump capacities were determined, and they can vary widely depending upon demand conditions. When a full data set is created using several assumptions, the confidence in the result can be significantly reduced, as is the value of the estimate in determining actual exposure.

At Camp Lejeune, the contamination of any single well contributing water to one of the water distribution systems would not instantly cause that level of contamination to be delivered to consumers because the water delivered to the tap is made up of water from numerous wells that are operated on a rotational basis. Unless a contaminated well was the only well operating at a certain time, the contaminated water would be diluted by water from other potentially cleaner wells.

The Holcomb Boulevard water treatment system began operation in 1972, serving the Paradise Point, Berkeley Manor, Watkins Village, and Midway Park family housing areas. Prior to this time, the Hadnot Point system was the source of drinking water for these areas. Between 1980 and 1985, 30 to 40 wells supplied the Hadnot Point water plant, which served the Base Industrial area, the Base Hospital, and 19 houses. In 1984 and 1985, the base closed 10 wells due to the presence of

TCE and PCE: two wells in Tarawa Terrace and eight at Hadnot Point (see Figure 1, Summary of Contaminated Wells).

Figure 1: Summary of Contaminated Wells

Well Number	Construction Date	Closure Date	Contaminant
Tarawa Terrace			
TT-23	1984	02/08/1985	PCE
TT-26	1952	02/08/1985	PCE
Hadnot Point			
HP-601	1941	12/06/1984	TCE
HP-602	1941	11/30/1984	TCE
HP-608	1941	12/06/1984	TCE
HP-634	1960	12/14/1984	TCE
HP-637	1970	12/14/1984	TCE
HP-651	1972	02/04/1985	TCE
HP-652	1972	02/08/1985	TCE
HP-653	1978	02/08/1985	TCE

3.2 USMC Environmental Organization Structure

As in the private sector, environmental organizations within the Department of Defense were evolving and expanding in the late 1970s and early 1980s in response to growing environmental concerns and federal compliance requirements. Although the lines of communication and the organizational reporting structure for environmental issues at Camp Lejeune could not be completely determined, the Panel has attempted to reconstruct the organization at the time.

Prior to October 1982, Camp Lejeune's Natural Resources and Environmental Affairs Division (NREAD) was a subset of the Base Maintenance Office (Attachment L). The water system was part of the Utilities Group and reported directly to Base Maintenance on an equal footing with NREAD, which included water quality (Attachment M). During this time, the organization of Preventive Medicine (Attachment N) shows that this department reported through a chain of command to the commanding officer of the Naval Hospital at Camp Lejeune. Thus, even though Elizabeth Betz, the base supervisory chemist, comments that Preventive Medicine was across the hall, the office apparently carried out its traditional independent advice and oversight as part of the hospital organization. Ms. Betz stated that she referred all sampling results to Preventive Medicine, but apparently no additional communication occurred (Betz Interview). Both Ms. Betz and Danny

Sharpe, her supervisor, have indicated that they did not have sufficient staff or funding in the early 1980s, nor the appropriate education and expertise in public health (Betz, Sharpe Interviews) to understand the potential problems associated with the VOC contamination identified in the drinking water. Betz stated that the laboratory was a low priority at the base, and they did not have the proper equipment or manpower at the time.

3.3 Camp Lejeune Environmental Initiatives

In 1977, the first regulations under SDWA became in effect, setting standards for microbiological contaminants, ten inorganic chemicals, six organic pesticides, turbidity, and radiological contamination. Camp Lejeune personnel collected samples from all eight of the drinking water supply systems (Courthouse Bay, Rifle Range, Onslow Beach, Hadnot Point, Holcomb Boulevard, Tarawa Terrace, Montford Point, and New River) in September 1977 and analyzed the samples for the required constituents. The laboratory results from the September 1977 sampling event indicated that none of target constituents were detected in any of the eight water system samples. No additional sampling events for these specific constituents have been identified (Southern Testing and Research Laboratories, 1977).

3.3.1 Camp Lejeune TTHM Sampling and Analysis (1980)

In November 1979, EPA published final regulations for control of TTHMs in drinking water; this regulation established an MCL of 10,000 µg/L and provided a schedule for compliance and monitoring. The regulation required community water systems serving between 10,000 and 75,000 people to begin mandatory monitoring of TTHMs by November 1982 and comply with the MCL by November 1983.

In October 1980, Camp Lejeune initiated voluntary TTHM sampling of the Hadnot Point and New River water distribution systems in anticipation of the November 1982 deadline. The systems were presumably sampled because they served between 10,000 and 75,000 people in accordance with the imminent EPA requirements. At this time, LANTDIV served in an advisory role to Camp Lejeune and facilitated implementation of the SDWA compliance program at the base. LANTDIV arranged for the analyses of the water samples, which were performed by the U.S. Army Environmental Hygiene Agency (USAEHA) laboratory in Fort McPherson, Georgia, and a private contractor, Jennings Laboratories. LANTDIV scheduled monthly TTHM sampling and analysis of the Hadnot

Point and New River water distribution systems from October 1980 through December 1981. The objective of sampling the water systems at Camp Lejeune and other Marine Corps facilities was to evaluate TTHM levels prior to the scheduled implementation of regulatory requirements.

On October 21, 1980, the base conducted TTHM sampling of the Hadnot Point and New River water distribution systems. USAEHA laboratory personnel developed TTHM Surveillance Reports to record the TTHM analytical results, which presumably were submitted to LANTDIV. The October 1980, December 1980, January 1981, and March 1981 TTHM Surveillance Reports indicated that water samples collected during these months contained chlorinated hydrocarbons that interfered with TTHM analyses. These results were the first indication that chlorinated hydrocarbons were present in the drinking water systems at Camp Lejeune. A summary of the hand-written notes for the TTHM Surveillance Report Forms is provided in Figure 2.

Figure 2: Notes of 1980–1981 Hadnot Point TTHM Analyses

Title	Note
TTHM Surveillance Report Form Camp Lejeune–Hadnot Point, collected 10/21/1980 (USAEHA, 1980)	“Water is highly contaminated with low molecular weight halogenated hydrocarbons. Strong interference in the region of CHCl_2Br .”
TTHM Surveillance Report Form Camp Lejeune–Hadnot Point, collected 12/18/1980 (USAEHA, 1980)	“Heavy organic interference at CHCl_2Br . You need to analyze for chlorinated organics by GC/MS.”
TTHM Surveillance Report Form Camp Lejeune–Hadnot Point, collected 01/29/1981 (USAEHA, 1981)	“You need to analyze for chlorinated organics by GC/MS.”
TTHM Surveillance Report Form Camp Lejeune–Hadnot Point, collected 02/26/1981 (USAEHA, 1981)	“Water highly contaminated with other chlorinated hydrocarbons (solvents)!”

No additional notes were included in the April 1981 and June 1981 TTHM Surveillance Report Forms, and no subsequent TTHM Surveillance Report Forms for Hadnot Point were identified in the available documents. All of the TTHM Surveillance Report Forms were signed by William C. Neal Jr., Chief, Laboratory Services. According to Mr. Neal, all copies of cover letters and analytical reports were provided to his major for signature and distribution to the facilities. Copies of the

original cover letters for these documents were not available for the Panel's review, and Mr. Neal does not recall to whom the letters were addressed (Neal Interview). There is no documentation that these reports were sent to Camp Lejeune directly. According to a memorandum from Ms. Betz dated February 12, 1982, Camp Lejeune requested copies of the TTHM results from LANTDIV in July 1981. In this memorandum, Betz wrote:

"Due to the location of the Chemical Dump and the results of analyses in the area of the Dump, in July 1981, Jerry Wallmeyer of LANTDIV arranged with the Army to increase the trihalomethane surveillance to include the Rifle Range Water System. Jerry Wallmeyer stated that surveillance had been arranged to continue through December 1981. At this time, it was learned that LANTDIV had been receiving the results and were holding them until all had come in. We then requested that the results be sent right away. In the cover letter received from LANTDIV with the results, LANTDIV stated that no action should be taken on Camp Lejeune's part until LANTDIV made their recommendations in December 1981."

A letter dated August 26, 1981, from LANTDIV to Camp Lejeune Assistant Chief of Staff for Facilities indicated that the TTHM Surveillance Reports were attached per the Camp Lejeune request (Bailey, 1981). Interviews present conflicting information about the dates Camp Lejeune personnel knew of the 1980–1981 sampling results. The Panel does not have a copy of the enclosed reports and does not know if the reports included Mr. Neal's handwritten notes.

It is likely that someone at LANTDIV reviewed Neal's reports but did not act. Jennings Laboratory reports show Mr. David Goodwin, a LANTDIV civil engineer, as the recipient. Mr. Goodwin denies seeing the reports (Goodwin Interview). In an interview with Jim Bailey, Head of Environmental Programs at LANTDIV, Mr. Bailey noted that Mr. Goodwin may have arranged the contract with Jennings and that is why his name appears on the results (Bailey, 2004). Mr. Bailey thought the analysis reports would have been directed to Steve Azar, the Head of Water Quality at LANTDIV, for review. James Chen, a water engineer who worked for Mr. Azar, stated that he and Mr. Azar read reports from numerous laboratories. Mr. Chen reported that he had no memory of reviewing drinking water analysis reports from Fort McPherson or Jennings Laboratories regarding Camp Lejeune during the time period in question (Chen, 2004). Mr. Azar stated that water analyses were not sent to LANTDIV directly; he would only review documents sent by specific installations for advice. Mr. Azar did recall meeting with Camp Lejeune NREAD personnel about different environmental issues. He recalled that Camp Lejeune was having trouble complying with new TTHM requirements. Mr. Azar did not remember specific information about VOC interference in TTHM samples. He stated that he documented every visit with the name of the person with whom

he met, what they discussed, and his recommendations (Azar Interview). The Panel has not seen these reports.

In a letter from LANTDIV to the Camp Lejeune Commanding General date stamped February 12, 1982, the findings of the TTHM monitoring program were discussed (Bailey, 1982). The discussion was limited to compliance with TTHM regulatory requirements, and no mention was made of the USAEHA findings regarding chlorinated hydrocarbons in the Hadnot Point water system.

3.3.2 Camp Lejeune TTHM Sampling and Analysis (1982–1983)

In February 1982, LANTDIV directed Camp Lejeune to begin TTHM monitoring using a laboratory certified by North Carolina. Camp Lejeune initiated this TTHM sampling in April 1982, using Grainger Laboratories. Grainger provided the first sampling report in April 1982, which summarized TTHM tests performed on samples taken at various points in the base's water supply system (Grainger Memorandum, August 1982). No individual wells were sampled. Chemists at Grainger Laboratories directed these reports to Ms. Betz, the supervisory chemist at Camp Lejeune.

The base collected monthly samples from the eight Camp Lejeune drinking water supply systems in April, May, June, and July 1982. Grainger contacted Ms. Betz by phone on May 6, 1982 to inform her that interferences from chlorinated hydrocarbons were apparent during the analysis of water samples from the Tarawa Terrace and Hadnot Point water systems (Grainger Laboratory, 1982). In a memorandum dated May 25, 1982, Ms. Betz indicates that on May 14, 1982, she briefed Lt. Col. Fitzgerald and Col. Millace on the April 1982 TTHM analysis from Grainger. The memorandum states the following:

“Col. Millace requested that a summary be prepared and submitted to him with the future trihalomethane analysis. No mention was made of extra peaks that Grainger found in the Tarawa Terrace and Hadnot Point Systems samples.”

In July 1982, base personnel collected additional water samples from the Tarawa Terrace and Hadnot Point drinking water systems for analysis by Grainger to identify the suspected chlorinated hydrocarbons. At this time, Grainger also analyzed water samples it had retained from a May 1982 TTHM sampling event to identify the specific chlorinated hydrocarbons detected in previous analyses. In August 1982, Camp Lejeune received analytical results that quantified TCE and PCE concentrations.

According to a memorandum from Ms. Betz to her supervisor, Mr. Sharpe, dated August 19, 1982, Grainger Laboratory reported interference from unknown chlorinated hydrocarbons during the analyses of water samples taken from the Tarawa Terrace and Hadnot Point water systems to Ms. Betz during a May 6, 1982, telephone conversation (Betz, August 1982). Grainger reported the results of the additional analyses of the Hadnot Point and Tarawa Terrace drinking water samples for TCE and PCE in a letter to the Commanding General of Camp Lejeune (carbon copied to Ms. Betz) dated August 10, 1982. This letter starts with the following discussion:

“Previously all samples from site TT and HP presented difficulties in performing the monthly Trihalomethane analyses. Interferences which were thought to be chlorinated hydrocarbons hindered the quantification of certain Trihalomethanes. These appeared to be at high levels and hence more important from a health standpoint than the total Trihalomethane content. For these reasons we called the situation to the attention of Camp Lejeune personnel.” (Grainger Laboratory, 1982).

TCE concentrations at Hadnot Point averaged 20 µg/L with one outlier at 1,400 µg/L; PCE concentrations at Tarawa Terrace ranged from 76–104 µg/L. The TCE levels in the Hadnot Point water were below the long-term TCE SNARL, and the PCE levels in the Tarawa Terrace water system averaged slightly above the PCE SNARL (Grainger Memorandum, August 1982).

Analytical results reported in this letter are summarized in the Figure 3. More extensive sampling results are provided in Attachment D.

Figure 3: Spring 1982 Sampling Data

Sample	Date Collected	Result (µg/l)	
		TCE	PCE
Tarawa Terrace 206	7-27-82	—	76
Tarawa Terrace 207	7-27-82	—	82
Tarawa Terrace 86	5-27-82	—	80
Sample	Date Collected	Result (ug/l)	
		TCE	PCE
Tarawa Terrace 168	7-27-82	—	104
Hadnot Point 208	7-27-82	19	<1
Hadnot Point 209	7-27-82	21	<1
Hadnot Point 120	5-27-82	1400	15
Hadnot Point 205	7-27-82	No data	1.0

— Not detected

Routing slips attached to the August 10, 1982 letter indicate it was forwarded to Environmental Affairs with the note:

Danny – see AC/S Fac request for interpretation by Betsy (Ms. Betz).

This document was also sent to the Base Maintenance Office, attention Lt. Col. Calta with the note:

Request you have your chemist provide 'lay-man' interpretation of findings. (Grainger Laboratory, 1982)

Betz's August 19, 1982, memorandum was likely developed in response to the routing request to Environmental Affairs discussed above. In this memorandum, Ms. Betz outlined that neither PCE nor TCE were regulated under the SDWA, but that EPA had developed SNARLs to provide guidance on unregulated contaminants. Ms. Betz concluded that the average levels of PCE detected in the Tarawa Terrace drinking water system were above the recommended SNARL for extended exposure, and the average levels of TCE detected in the Hadnot Point drinking water system were below the recommended SNARLs. A handwritten note attached to the memorandum (apparently from Mr. Sharpe) stated:

"Special testing of TT & HP plants for Trichloroethylene & Tetrachloroethylene. Both within limits. Recommend sending data to LANTDIV. (Betz, 1982)"

There is no record available that indicates if the data was forwarded to LANTDIV.

All TTHM results for water samples taken from April–July 1982 were at or below the regulatory limits that existed at that time, and no regulations were yet in place for TCE and PCE. From these findings, the monitoring frequency for TTHM was reduced from monthly to quarterly for the Tarawa Terrace and Hadnot Point water systems, as well as four of the six other Camp Lejeune drinking water systems. Monthly sampling for TTHM continued for the Rifle Range and New River drinking water systems.

The base analyzed the eight water systems for TTHMs again in November 1982. These samples indicated sporadic interference from VOCs in the samples from the Tarawa Terrace and Hadnot Point water supply systems. According to a memorandum from Ms. Betz to Mr. Sharpe dated December 21, 1982, the Grainger chemist expressed concern that although the interference levels had dropped in the Tarawa and Hadnot Point samples for a brief period (May 1982–July 1982),

levels of interference from chlorinated solvents were relatively high again in the November samples.

In the memorandum Ms. Betz stated:

"3. When I called Grainger about the error, I talked to Bruce Babson, the chemist who runs our samples. He expressed concern over the solvents that interfere (sic) with Tarawa Terrace and Hadnot Point samples, particularly Hadnot Points (sic). He stated that levels had dropped for a while. However in these last samples the levels were relatively high again." (Betz, 1982)

All eight water systems were sampled and analyzed for TTHMs again in February 1983 and August 1983. There is no indication that the February results noted VOC interference. The Grainger Laboratory report dated September 16, 1983 provided TTHM data for the samples collected in August 1983 from all eight Camp Lejeune drinking water supply systems. According to the laboratory report, all samples from the Tarawa Terrace water system *"exhibit contamination from Tetrachloroethylene"* and all samples from the Hadnot Point water system *"exhibit contamination from both Trichloroethylene and Tetrachloroethylene"* (Grainger Laboratory, 1983). The laboratory report was addressed to the Quality Control Lab at Camp Lejeune, Attention: Commanding General.

On May 25, 1983, EPA sent a letter to the Office of the Secretary of Defense in response to a letter sent by a Colonel Daley on May 3, 1983 (Hedeman, 1983). This letter outlines EPA's position on TCE levels in drinking water and indicates that EPA was developing a drinking water standard for TCE that would be in the general range of 5–50 µg/L. There is no indication that this letter or the information about TCE was forwarded to Camp Lejeune.

3.3.3 Camp Lejeune Response Actions: Hadnot Point and Tarawa Terrace

Camp Lejeune environmental personnel initiated the Navy Assessment and Control of Installation Pollutants (NACIP) Program at the base in January 1982 with an Initial Assessment Study (IAS). The objective of the IAS was to *"collect and evaluate evidence which indicates existence of pollutants that may have contaminated a site or that pose a potential health hazard for people located on or off an installation."* During the IAS, 75 potential sites were identified at Camp Lejeune, and of those, 22 were considered priority sites that required further study. In July 1984, the base initiated the NACIP Confirmation Study (CS). The Confirmation Study included the sampling of any community water supply well in the vicinity of a priority site, such as Hadnot Point. This is significant, as prior samples were drawn at the water treatment plants or in the distribution system—not from individual wells. The water at the treatment plants was drawn from multiple wells on a rotational basis. The Panel does not have specific information about the rotational schedule of the wells. It does recognize, however, that

when multiple wells provided water to the treatment plants, sampling the water at the treatment plant was not an effective method for determining contamination in individual wells (NACIP, 1983).

3.3.3.1. Closure of Drinking Water Wells at Hadnot Point

In November 1984, the base received results of the NACIP investigation that revealed areas of environmental contamination. Based on a direct association established between contamination in the Hadnot Point water system and the VOCs detected in the drinking water wells, water system operators began shutting down contaminated wells in Hadnot Point in November.

According to a telephone log completed by Robert E. Alexander, who was hired to oversee the NACIP Program at Camp Lejeune, on December 6, 1984, Mr. Bailey of LANTDIV notified Camp Lejeune of analytical results from the NACIP Confirmation Study. According to the log, Mr. Bailey informed Mr. Alexander that benzene and TCE were detected in Hadnot Point well 602. TCE was also found in Hadnot Point wells 601, 602, 603, 608 and in the finished water at Building 20. TCE concentrations ranged from 4.6–1,600 µg/L. The telephone log continued as outlined below:

"2. Mr. Bailey informed me that benzene was confirmed in Well No. 602, from which the pumping has been stopped. Trichloroethylene (TCE) was also found in Well No's. 602, 601, 603, 608, and in the finished water at Bldg 20, the Hadnot Pointe Water Plant. TCE levels at Well No. 603 were so low as not to be of concern at the present time. The test for benzene in the Bldg 20 finished water revealed no detectable level. Well No. 634 was also examined and revealed no detectable levels of volatile organic compounds.

3. Mr. Bailey and I agreed that confirmation testing should be initiated as soon as possible at these and other nearby wells in the system. Samples of finished and raw water samples at Bldg 20 should also be analyzed until further notice. Re-sampling of Wells 610, 603, and 608 should also be completed to confirm detection of these compounds.

4. Mr. Bailey stated that a message was forthcoming which described a plan of action to address the problem. The plan would include additional sampling of the system and wells to pinpoint the area contaminated.

NOTE: After briefing Col Lilley and LtCol Fitzgerald at about 1430, I advised Mr. Cone, BMAIN, to shut down Wells 601 and 608. (Alexander, 1984)

On December 6, 1984, Hadnot Point wells 601 and 608 were shut down, while well 602 remained offline. The North Carolina Division of Health's records indicated that they were formally notified of the VOC contamination on December 10, 1984 (Bell Memorandum, December 1984). Three days later, the base newspaper published its first story about water testing, contamination, and corrective actions (Goodwin Memorandum, January 1985).

On December 14, 1984, Hadnot Point wells 634 and 637 were also shut down. On February 4, 1985, Camp Lejeune received the January 1985 sampling results, which revealed that well 651 in Hadnot Point contained 400 µg/L PCE, 18,900 µg/L TCE, and 8,070 µg/L DCE. The well was immediately taken off line.

3.3.3.2. Closure of Drinking Water Wells at Tarawa Terrace

In January 1985, Camp Lejeune decided to test all drinking water wells for VOCs. On February 8, 1985, well TT-23 (drilled in 1984) and TT-26 were closed in response to contamination detected in these wells. A Camp Lejeune staff report discussed the closure of wells TT-23 and TT-26 and projected a 300,000-gallon per day shortage of water due to the well closures. It recommended extending an auxiliary line from Brewster Boulevard (Holcomb Boulevard water distribution system) to Tarawa Terrace, as well as imposing water conservation restrictions *"due to the inability to meet water demand without these wells."* (Summary of December 1984 water sampling at Hadnot Point, 1984).

In March 1985, Camp Lejeune developed a plan to construct an 8-inch emergency auxiliary water line from the Holcomb Boulevard water treatment plant to Tarawa Terrace to compensate for water shortages caused by well closures in the Tarawa Terrace water system. This project was completed in June 1985, resulting in the lifting of water restrictions at Tarawa Terrace and closure of all Tarawa Terrace wells. In July 1985, the base began a project to expand the Holcomb Boulevard water treatment plant from 2 to 5 million gallons per day (MGD) to meet the additional water demand from the Tarawa Terrace system. This project, completed in March 1987, provides water to the Tarawa Terrace system.

On May 15, 1985, the NCDEM issued a Notice of Violation (NOV) to the Commanding General at the Camp Lejeune. The NOV, based on regulations effective September 1984, was issued in response to data developed in the NACIP CS, which identified ten drinking water supply wells contaminated with organic compounds. As stated earlier, Camp Lejeune had initiated the CS that identified the contaminants in July 1984. The NOV identified eight Hadnot Point water supply wells (HP-601, HP-602, HP-603, HP-608, HP-634, HP-637, HP-642, and HP-651) and two Tarawa Terrace water supply wells (TT-26 and TT-23) contaminated with organic constituents, including PCE, TCE, 1,2-trans-dichloroethylene, methylene chloride, vinyl chloride, 1,1-dichloroethane,

benzene, toluene, and dichlorobenzene. The NCDEM NOV concluded that the contamination identified in the Tarawa Terrace wells likely originated from a nearby dry cleaner (ABC Cleaners), as opposed to Camp Lejeune operations (Von Oesen and Associates, 1979). Camp Lejeune had already shut down the wells cited in the NOV in November and December 1984 and February 1985.

3.3.3.3. USMC Public Communications Regarding Hadnot Point And Tarawa Terrace Water Systems (1980–1985)

This section provides a summary of the actions Camp Lejeune took to notify the public of the contaminants associated with the Hadnot Point and Tarawa Terrace drinking water systems through 1985.

December 1984: According to a memorandum from the North Carolina Division of Health Services (NCDHS), Camp Lejeune contacted NCDHS by telephone on December 10, 1984 regarding suspected contamination of four wells. The memorandum indicated that the wells were removed from service, that a re-sampling program would be initiated by Camp Lejeune, and that “*some form of information may be released to the public.*” According to a written response developed by Marine Corps Headquarters to questions from *The Washington Post* (September 11, 2003):

“Two days after contacting the North Carolina’s Division of Health Services, Camp Lejeune began to notify its residents on Dec 13, 1984. An article in Camp Lejeune [sic] The Globe, ‘Camp Lejeune Water Testing Underway,’ described the sampling efforts to test water base-wide as a result of water samples taken on Dec 3 at Hadnot Point Industrial Area, which were found to contain organic compounds.”

In addition, a memorandum dated January 4, 1985 indicated that the MCB Commanding General provided a press conference on December 14, 1984 as part of the “Response to MCB VOC Problem” (U.S. Marine Corps Camp Lejeune, 1984).

December 1984 (estimated): A document entitled *Questions and Answers Relative to Wells at Camp Lejeune* appears to have been distributed as a press release or prepared in preparation of a press release. Based on the content, the document appears to have been developed in the December 1984 timeframe, but it could have been developed later. The content, limited to the Hadnot Point well system, discussed the detection of VOCs in Hadnot Point wells 602 (primarily), 601, and 608, and outlined that the contaminants were discovered as part of the NACIP Confirmation Study. In response to the question of what was currently being done, the document stated:

Well 602 hasn't been used since 11/21—it was shut down as part of regular rotation of ten or so wells that supply the main plant for Hadnot Point. We are developing a change order to the Confirmation Study to step up the sampling of all wells in the Hadnot Point area. We have recommended that Camp Lejeune shut down Wells, 601, 602, 608 immediately; retest all previously sampled wells in the area, initiate daily sampling of the main plant. U.S. Marine Corps Base Camp Lejeune, 1984)

April 1985: On April 30, 1985, the USMC at Camp Lejeune issued a “Notice to Residents of Tarawa Terrace” regarding problems with the water supply. According to the notice:

Two of the wells that supply Tarawa Terrace have had to be taken off line because minute (trace) amounts of several organic chemicals have been detected in the water. There are no definitive State or Federal regulations regarding safe levels of these compounds, but as a precaution, I have ordered the closure of these wells for all but emergency situations when fire protection or domestic supply would be threatened.

The notice requested that residents take active measures to reduce domestic water use until early June when construction of an auxiliary water line from the Holcomb Boulevard water treatment plant would be completed (U.S. Marine Corps Base Camp Lejeune, 1985).

May 1985: Camp Lejeune provided a press release on May 9, 1985 that informed the general public of the water situation at Camp Lejeune. The *Jacksonville Daily News* (Smith, 1985) and the *Wilmington Morning Star* (Long and Brennan, 1985) ran related stories on May 10, 1985 and May 11, 1985, respectively.

September 1985: A September 15, 1985 article in the *Raleigh News and Observer* provided a summary of the ongoing investigation and groundwater contamination at Camp Lejeune. The article also stated:

Camp Lejeune authorities in May notified base residents and water customers of the contaminants with leaflets and articles in the base newspaper. (Allegood, 1985)

3.4 Detailed Findings

After review and analysis of the available information, the Panel finds the following:

1. **Camp Lejeune provided drinking water to base residents that was of a quality consistent with general water utility practices in light of the evolving regulatory requirements at the time.**

Responses from all levels of Camp Lejeune personnel must be considered in the context of the contemporary scientific knowledge and regulatory framework that existed in the early 1980s. Faced with rapidly changing U.S. water quality regulations and practices during that time, Camp Lejeune personnel responded, but not expeditiously, to the contamination situation that confronted them. Although some utilities in the United States did take a progressive stance and acted to eliminate or treat VOC-contaminated sources before being mandated to do so, this was not common practice. The Panel's review indicated that Camp Lejeune's practices were consistent with the regulatory requirements, water industry practices, and military protocols of 1980–1985. As a result, base residents received water that was comparable in quality to water provided by average civilian water utilities and other military base water systems.

2. **Camp Lejeune made every effort to comply with existing water quality regulations and related schedules, but did not anticipate or independently evaluate health risks associated with chemicals that might be subject to future regulation. In 1980, there was developing concern about the potential health effects of exposure to TCE and PCE, and the EPA was just beginning to move toward establishing standards by issuing “suggested no-adverse response levels” for these chemicals.**

Camp Lejeune's sampling program for microbiological contaminants, lead, and total trihalomethanes—the emerging contaminants of concern of the early 1980s—reflects the standard practice of most water utilities at that time, i.e., to establish monitoring and compliance programs for contaminants *only after* regulatory standards had been issued. Similarly, military bases would not budget expenditures to control contaminants *until* compliance and monitoring standards had been promulgated for those contaminants. At the time that VOCs were first detected at Camp Lejeune, EPA had not established drinking water standards for TCE and PCE. Therefore, the operation of Camp Lejeune's water

supply system during 1980–1985 did not include regular sampling and analysis for these contaminants.

3. **Confounding factors that appear to have hindered Camp Lejeune personnel from quickly recognizing the significance of the VOC contamination include the following: the absence of regulatory standards, no records of resident complaints about water quality, sampling errors, and inconsistent sampling results attributable to a multiple-well system that diluted or masked evidence of significant contamination from any one source.**

In the early 1980s, Camp Lejeune conducted sampling on finished (blended and treated) drinking water at the water treatment plants or distribution locations, which was a mixture of water drawn from numerous wells on a rotational basis. This multiple-well rotation system contributed to apparently inconsistent VOC sampling results or anomalies because the VOC concentration in the samples would fluctuate depending upon the wells that were in operation at the time. In 1984, Camp Lejeune began sampling *individual* wells, as opposed to finished drinking water at the water treatment plants, as part of the NACIP Confirmation Study. This new sampling practice revealed the extent of VOC contamination and provided confirmation on the locations affected by VOCs.

In the course of reviewing the “Summary of Analytical Data” (Attachment D), it appears that the sampling results confused base personnel since the results varied over time.

On May 27, 1982, the only high TCE reading (1,400 µg/L) occurred at Hadnot Point. To be considered significant, the result would have to be confirmed through further sampling. The May 27, 1982 samples from three locations on Hadnot Point, however, averaged only 20 µg/L. The base analyzed the eight water systems for TTHMs again in November 1982, and analyses indicated higher levels of VOC at Hadnot Point and Tarawa Terrace. Of the 11 samples drawn from the Hadnot Point treatment plant in December 1984, ten showed concentrations less than 10 µg/L, while one showed a concentration of 190 µg/L. This was followed by a peak of 900 µg/L in January 1985.

4. **LANTDIV, as a technical advisory organization, apparently was not aggressive in providing Camp Lejeune's Environmental Division with technical expertise to understand the significance of the VOCs and how they could have been addressed.**

LANTDIV's role was to provide technical expertise to Camp Lejeune personnel and advise them on how to address and verify the indications of VOCs in the sampling results. In 1980 and 1981, four laboratory analytical reports contained notes alerting LANDTIV to the presence of VOCs and recommended further study. Such studies, however, were not undertaken, nor did Camp Lejeune have the equipment or expertise to conduct the suggested analyses. The Panel's investigation found no evidence of LANTDIV's responses to these analytical report notes nor any follow-up actions or recommendations.

5. **Inadequate funding, staffing, and training of Camp Lejeune's Environmental Division, combined with the Division's compliance-based approach to regulations, contributed to a lack of understanding about the potential significance of the VOCs identified in the drinking water in the early 1980s.**

The Environmental Division monitored Camp Lejeune's water quality through a basewide, large-scale compliance program that involved continual and repetitive samplings.

Environmental Division personnel, tasked with the routine sampling and testing of Camp Lejeune's water supply, relied on other organizations, such as Preventive Medicine and LANTDIV, for regulatory and scientific information and direction on emerging water contamination issues. In interviews conducted with Environmental Division personnel, they consistently revealed that the organization was given a low priority by base leadership and did not have the appropriate equipment or qualified personnel to test for solvents until 1984. Interviewees also confirmed that TTHM testing was the Environmental Division's main priority at that time. Interviewees repeatedly stated that they did not understand the significance of the laboratory results. One interviewee also stated that although in-service training was provided, it focused on new laws and regulations and did not address solvent issues or groundwater contamination.

The lack of quick and aggressive response to initial chemical interferences, later determined to be VOCs, in some drinking water samples was unfortunate. The priority for responding to initial indications of unknown contaminants was low, and the Environmental Division's

compliance-based approach contributed to personnel not questioning the significance of these signs and pursuing them within the Camp Lejeune organization.

6. Communications among Camp Lejeune's water system operators, the Preventive Medicine Department, the Environmental Division, and LANTDIV were inadequate.

The lack of coordination among Camp Lejeune's water system operators, Preventive Medicine, Environmental Division, and LANTDIV resulted in the poor communication of drinking water contamination issues to the residents of Camp Lejeune. Despite this inadequate communication network, both internally within Camp Lejeune and between Camp Lejeune and LANTDIV, a more apparent and urgent contamination incident likely would have generated more effective dissemination of information. For example, the gasoline leak that occurred in the Holcomb Boulevard system in January 1985 generated an effective communications response. Therefore, had Camp Lejeune personnel been more knowledgeable about the nature and extent of the VOC contamination, it would have been of higher priority and might have resulted in better communication among Camp Lejeune's Preventive Medicine, Environmental Division, various water system operators, and LANTDIV.

7. Communications to Camp Lejeune residents regarding drinking water contamination did not fully characterize the contaminant levels found at the time of the well closures.

Camp Lejeune's April 30, 1985 notice to residents of Tarawa Terrace characterized the levels of "*several organic chemicals*" in the water supply as "*minute (trace) amounts*" although tests were showing results, albeit inconsistent, ranging up to 1,580 µg/L. The public release also noted that the well closures were being taken as a "*precaution,*" although "*there are no definitive state or federal regulations regarding a safe level of these compounds.*" A May 11, 1985 news report said that "*Camp Lejeune should not worry about getting bad drinking water*" in the opinion of the head of North Carolina's Water Supply Branch, who added, "*I think we kind of caught it right at the beginning. It's not something that has been running for two or three years.*"

8. The Panel found the Marine Corps acted responsibly, and saw no evidence of Marine Corps attempts to cover up information that indicated contamination in Camp Lejeune drinking water.

Notwithstanding the water system operators' lack of understanding of the significance of VOC interferences in TTHM samples, the Panel found no evidence of attempts to conceal sampling data that were later found to be indicators of VOCs. Furthermore, Camp Lejeune's sampling protocol for TTHM testing in drinking water provides evidence of no attempt to cover up the presence of contaminants in drinking water supply systems. Given that more than two decades have passed since the initial indications of VOC contamination, a lack of complete information on related decisions was expected. The scope of the Panel's interviews and research makes it unlikely that new information coming to light would indicate a cover-up.